Surgical Technique

smith&nephew

TRIGEN◇ META-NAIL◇

Tibial Nail System

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Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.

Introduction

The following technique is for informational and educational purposes only. It is not intended to serve as medical advice. It is the responsibility of treating physicians to determine and utilize the appropriate products and techniques, according to their own clinical judgement, for each of their patients. For more information on the TRIGEN® META-NAIL® Tibial Nail System, ncluding its Indications for Use (REF 81068703), contraindications, and product safety information, please refer to the product's label, the Instructions for Use packaged with the product, and, if using the TRIGEN SURESHOT® Distal Targeting System, the TRIGEN SURESHOT Distal Targeting System User Manual (REF 7118-1540).

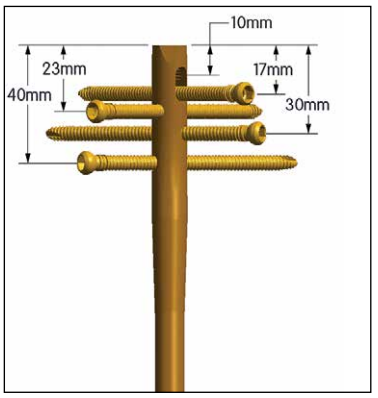
The TRIGEN META-NAIL Tibial Nail System is designed specifically to repair fractures of the proximal and distal thirds of the tibia, including the shaft, stable and unstable fractures, nonunions, malunions, and for the prophylactic nailing of impending pathological fractures.

The META-NAIL System can be used with or without the SURESHOT Distal Targeting System. If using the SURESHOT Distal Targeting System, be sure to read and understand the TRIGEN SURESHOT Distal Targeting System User Manual (REF 7118-1540). Only trained operators are allowed to use the TRIGEN SURESHOT Distal Targeting System.

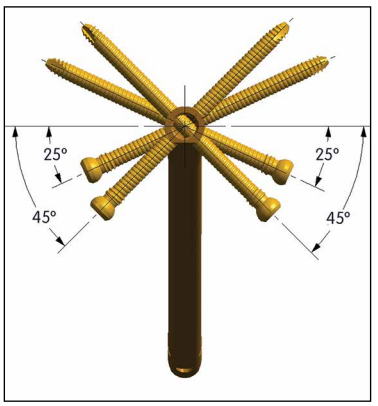
TRIGEN® META-NAIL® Tibial Nail Specifications

ML view

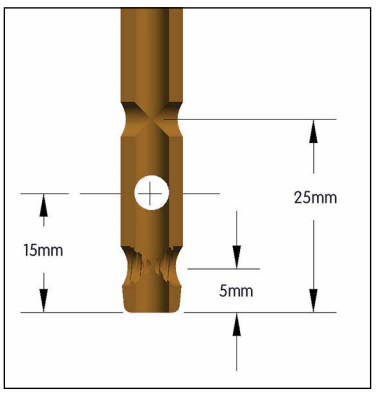
Figure 1



Distal end of nail
(all knee and distal tibial)



Top view of nail



Non-driving end of nail
(AP view)

Specifications	TRIGEN META-NAIL Tibia (8.5mm)	TRIGEN META-NAIL Tibia (10, 11.5 and 13mm)
Material	Ti6Al4V	Ti6Al4V
Diameter	8.5mm	10, 11.5 and 13mm
Lengths	16-50cm*	16-50cm*
Nail Color	Grey	Gold
Cross Section	Round	Round
Proximal Diameter (driving end)	12mm	12mm (10, 11.5 diameter) 13mm (13 diameter)
Distal Diameter (non-driving end)	8.5mm	10, 11.5 and 13mm
Smallest Thru Diameter	4.8mm	5.0mm
Wall Thickness	1.9mm	2.3mm (10) 3.0mm (11.5) 2.3mm (13)
Guide Bolt Thread	5/16-24 UNF	5/16-24 UNF
Screw Diameter	4.5mm	5.0mm
Screw Color	Grey	Gold
Major Diameter	4.5mm	5.0mm
Minor Diameter (core)	4.0mm	4.3mm
Screw Lengths	25-65mm	25-110mm
Hex Size	4.7mm	4.7mm
Alternative Hexdrivers	RT Femoral & Recon 7.0mm Cannulated Screw PERI-LOC® Locking Screw	RT Femoral & Recon 7.0mm Cannulated Screw PERI-LOC 4.7mm Hexdriver, PROFIX® 4.7mm Hexdriver
Alternative Modes	No	No
Proximal Locking (Driving End)		
Static Lock Locations/Orientations	17mm/45° Screw Locked w/META-NAIL Cap 23mm/45° Threaded w/bushing 30mm/25° Threaded 40mm/25° Threaded	
Static Locking Hole Dimensions	Threaded 4.3mm minor diameter Threaded 4.7mm major diameter	Threaded 4.5mm minor diameter Threaded 5.3mm major diameter
Compression/Dynamic Slot Location	10mm	10mm
Compression/Dynamic Slot Diameter/Length	4.7mm/7mm	5.3mm/7mm
Degree of Proximal Bend (Herzog)	10°	10°
Proximal Bend Location	27mm	27mm
Distal Locking (Non-Driving End)		
Static Lock Locations/ Orientations	25mm/ML 15mm/AP 5mm/ML (Threaded)	25mm/ML 15mm/AP 5mm/ML (Threaded)
Static Locking Hole Dimensions	4.7mm**	5.3mm**
Degree of Distal Bend	2°	2°
Distal Bend Location	60mm	60mm

Note: These views are not to scale and should be used as a pictorial representation only.

* Set does not include all sizes.
**Most distal hole threaded.

Surgical Technique

Patient positioning

1. Position the patient supine on a radiolucent table with the unaffected limb extended away from the affected limb (Figure 1). Alternatively, a fracture table may be used with a pin inserted through the calcaneus to place the leg in traction.

   Flex the affected limb 80–90° and check for length and rotation by comparison to the unaffected limb.

2. Use a bolster or radiolucent triangle to maintain limb position (Figure 2).

   Caution If using the TRIGEN® SURESHOT® Distal Targeting System, do not use a metal triangle. Verify that there are no other metal objects (including metal triangles) in the immediate targeting area. Metal interference will cause the SURESHOT System to be inaccurate.

3. Rotate the C-Arm to ensure optimal AP (anteroposterior) and lateral visualization of the entire tibia. A distraction device may also be applied to obtain and/or maintain traction.

Figure 1

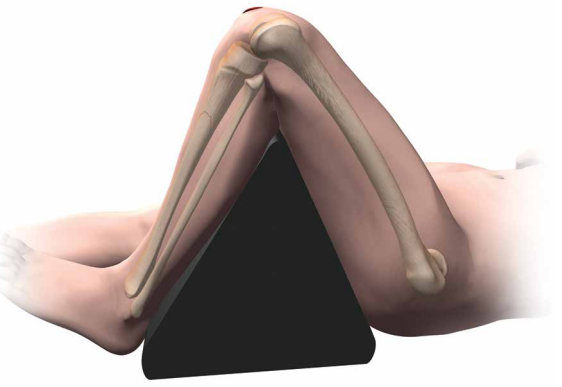


Figure 2

Establish the incision and entry portal

1. Assemble the Honeycomb (7167-4075), Entry Portal Handle (7167-4092) and Entry Portal Tube (7167-4060) (Figure 3). The pieces will lock in place securely at either 0° or 180°.

   Optional: *Suction can be applied to the Entry Portal Handle.*

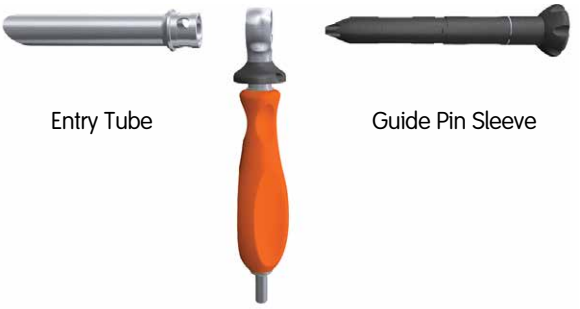


Figure 3

2. Make a 2cm incision in line with the intramedullary canal (Figure 4). Orient the incision so that it is patellar-splitting, medial or lateral parapatellar.

   Note: Locate the entry point for the 3.2mm Brad Point Guide Pin just medial to the lateral tibial eminence in the AP view, in line with the anterior cortex and intramedullary canal in the lateral view (Figure 5).

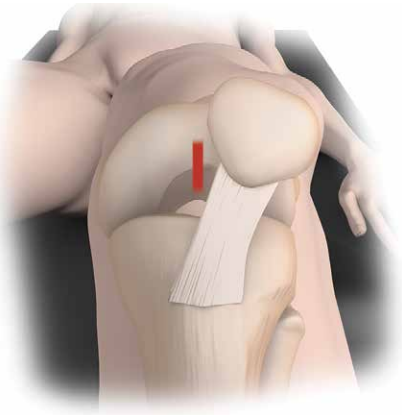
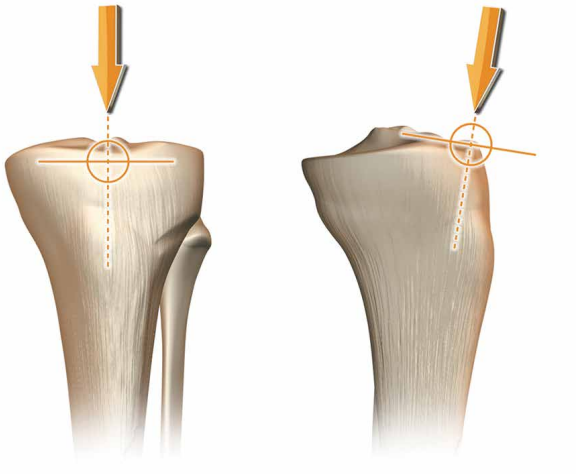


Figure 4



AP Lateral

Figure 5

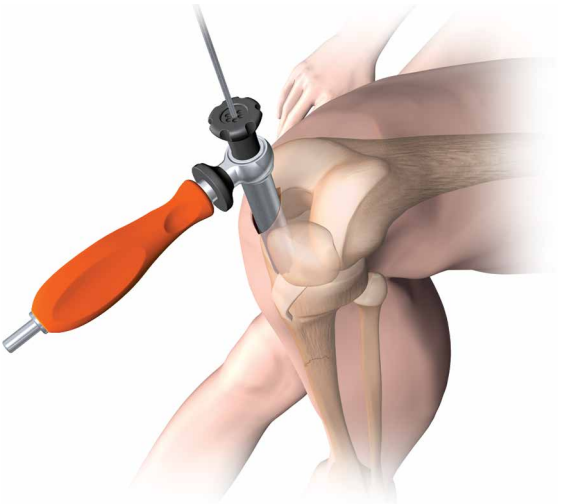


Figure 6

3. Attach a 3.2mm Brad Point Guide Pin (7167-4130 or 7163-1436) to the drill via the Mini Connector (7163-1186).

   Note: A wire driver can be used in place of the Mini Connector.

4. Insert the guide pin into the proximal tibia to a depth of 4–6cm (Figure 6).

   Note: The Entry Portal instrumentation serves as a soft-tissue protector.

   Note: If suboptimal guide pin insertion occurs, rotate the Honeycomb within the Entry Tube to the desired location and insert another 3.2mm Brad Point Guide Pin (Figure 7).

   Note: Do not over-insert the guide pin as this can establish a false trajectory and cause fracture malalignment.

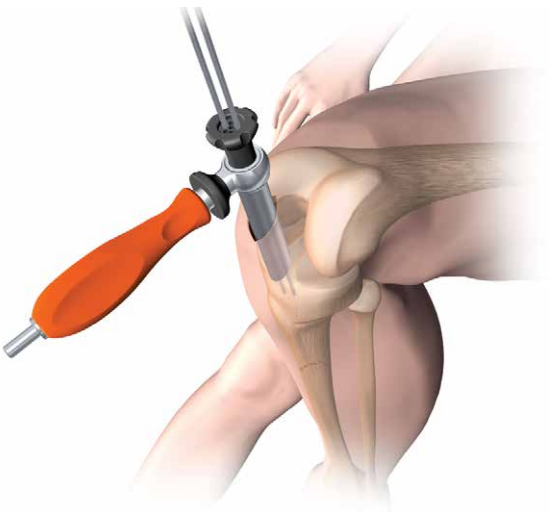


Figure 7

5. After the guide pin is in place, remove the Honeycomb from the Entry Tube, along with any other guide pins.
6. Check the guide pin position via radiographic imaging.
7. Advance the 12.5mm Entry Reamer (7163-1116) over the guide pin through the Entry Tube to a depth of 4–6cm (Figure 8).

   Note: Avoid penetration of the posterior cortex.
8. Remove the Entry Reamer and guide pin.

Alternative technique: Entry portal

9. Attach the T-handle (7167-4076 or 7167-4576) to the Cannulated Awl (7167-4000) (Figure 9).
10. Insert the awl into the proximal tibia to a depth of 4–6cm.

    Note: The Cannulated Awl is 9.5mm in diameter. Additional reaming is required for nail entry.
11. Insert the 3.2mm T-handle Trocar (7167-4074) (Figure 10) into the rear of the assembly prior to insertion in order to prevent awl slippage and accumulation of cortical bone within the cannulation.

Figure 8

Cannulated Awl with T-handle

Figure 9

3.2mm T-handle Trocar

Figure 10

Reduce the fracture

1. Open the Gripper (7167-4080).
2. Insert the smooth end of the 3.0mm Ball Tip Guide Rod (7163-1626) into the front of the Gripper (Figure 11).
3. Close the Gripper.
4. Connect the 8.5mm Reducer and the Reducer Connector (7167-4077) so that the words “Slot Orientation” on the connector are in line with the opening at the Reducer’s tip (Figure 12).
5. Complete the assembly by connecting the Reducer and connector to the T-handle (7167-4076 or 7167-4576).

   Note: If blocking screws are desired at this point in the procedure, refer to the blocking screw technique section of this surgical technique.
6. Advance the Reducer into the intramedullary canal (Figure 13).
7. Use the curved tip to direct the 3.0mm Ball Tip Guide Rod past the fracture into the region of the distal epiphyseal scar. The guide rod should be center-center in the AP and lateral views.
8. Once the guide rod is at the desired depth, detach the Gripper and prepare to remove the Reducer from the tibial canal.
9. During extraction, slide the Obturator (7167-4078) into the T-handle in order to maintain guide rod position within the canal (Figure 14).
10. Remove the Reducer from the tibial canal.

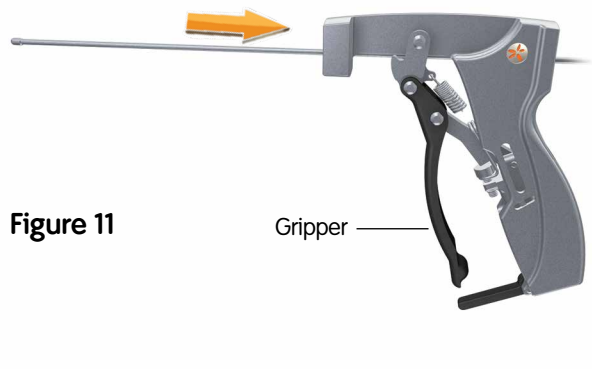


Figure 11

Figure 12

Figure 13

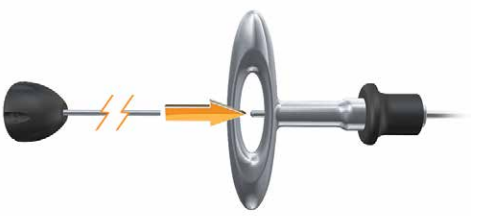


Figure 14

Determine the implant length

1. Confirm that the Ruler opens easily. If it does not, adjust the thumb-wheel connection at the end to ensure free movement.
2. After the Reducer has been removed, reconfirm the guide rod placement within the distal tibia.
3. Slide the Ruler (7167-4079) over the guide rod until the metal tip contacts the proximal tibia (Figure 15).
4. Confirm the guide rod position in the window at the opposite end of the Ruler as shown in order to ensure accurate implant measurement (Figure 16).
5. Push down on the top of the Ruler until it contacts the 3.0mm Ball Tip Guide Rod.

   Note: Ensure that the ruler is in contact with the Ball Tip Guide Rod.
6. Read the implant length from the exposed calibrations at the end of the Ruler.
7. Confirm fracture reduction to ensure that the implant length is not underestimated. Reference the fibula for accurate fracture distraction or compression.

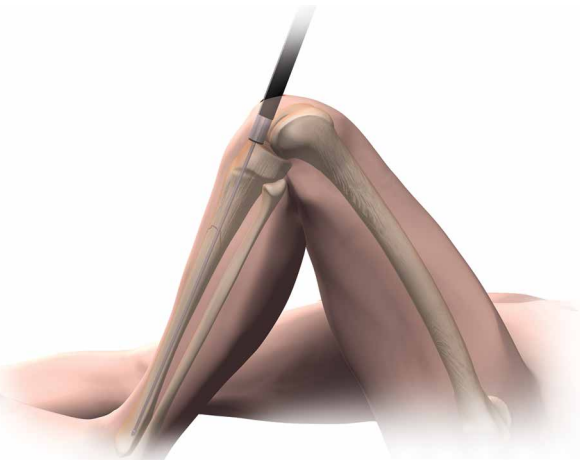


Figure 15

Figure 16

Unreamed technique

1. Use radiographic templating to determine nail size (Figure 17).

   Note: The appropriate-diameter implant provides translational fill within the isthmus of the intramedullary canal.

2. To help avoid implant incarceration during insertion, select a nail approximately 1.0–1.5mm less than the narrowest canal measurement on the lateral radiograph.

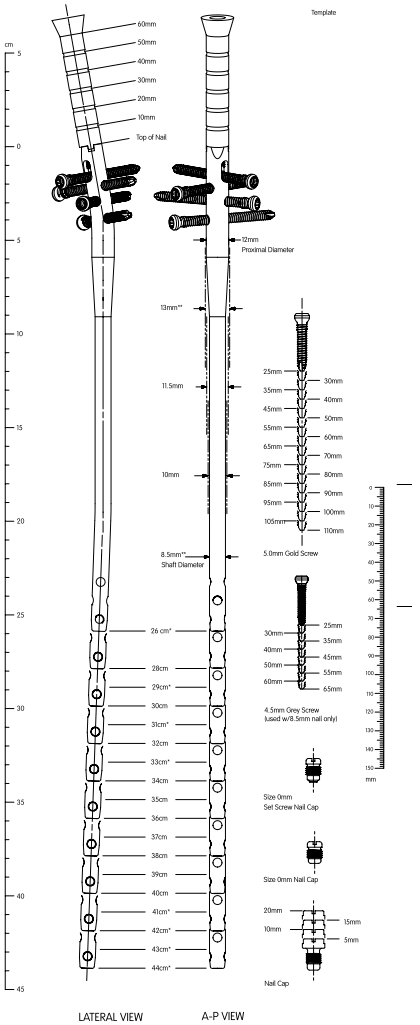


Figure 17: TRIGEN® META-NAIL® Tibial Nail Radiographic Template, Cat. No. 7118-0810

Reamed technique

1. Use radiographic templating to determine nail size.
2. Use the 9.0mm Front Cutting Reamer Head (7111-8231) and Flexible Reamer Shaft (7111-8200) to ream the intramedullary canal sequentially in half-millimeter increments to a size 1.0–1.5mm larger than the selected nail size (Figure 18).
3. To ensure Guide Rod placement during reaming, insert the Obturator (7167-4078) into the back of the Reamer unit during retraction.
4. Continue to confirm Guide Rod placement in the distal tibia throughout reaming.

   Note: Periodically move the reamer back and forth in the canal to clear debris from the cutting flutes.

Figure 18

Nail assembly

1. Use the Guide Bolt (7165-4506) to attach the META-NAIL® Drill Guide (7165-4502) to the nail.
2. Tighten with the Guide Bolt Wrench (7163-1140) and T-handle. The nail is correctly aligned when:
   - The vertical black line on the posterior side of the insertion barrel aligns with the line on the posterior side of the nail.
   - The "A" on the anterior side of the nail aligns with the "A" on the anterior side of the insertion barrel (Figure 19).
   - The apex of the nail's proximal Herzog Bend faces posteriorly and the Drill Guide is oriented anteriorly (Figure 20).

   Note: The bevel on the front of the nail marks the connection to the Drill Guide and can be seen in the lateral view as a means to determine proximal insertion depth.

   Note: The standard META-NAIL Drill Guide and Guide Bolt are recommended for use for compression or dynamic locking. When compared to using the META-NAIL Extension Drill Guide, the longer insertion barrel of the standard META-NAIL Drill Guide facilitates countersinking of the nail.

   Note: The assembly and insertion of the grey 8.5mm diameter META-NAIL Tibial Nail follows the same technique as the 10mm, 11.5mm and 13mm diameter nails.
3. Attach the Cannulated Impactor-Medium (7167-5081) to the Drill Guide (Figure 21).
4. Attach the Anterior Drop (7165-4501) to the Drill Guide (Figure 21).
5. To verify the accuracy of the target, insert a gold 9.0mm Drill Sleeve (7163-1152) and silver 4.0mm Drill Sleeve (7167-4083) into the Drop.
6. Pass a 4.0mm Long Pilot Drill (7163-1110)* through the assembly.

   Note: An incorrectly attached nail will not target.

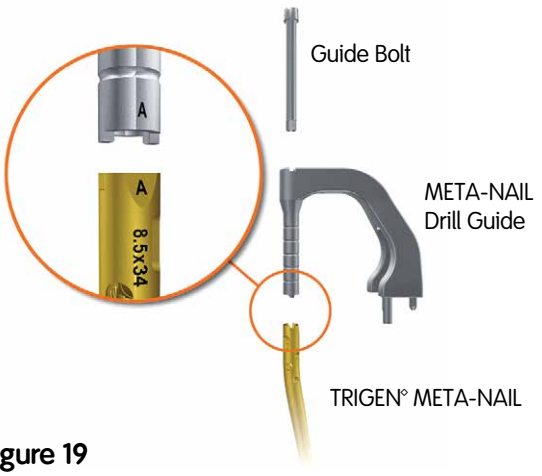


Figure 19

Figure 20

Figure 21

*The 4.0mm Long Pilot Drill (7163-1110) is interchangeable with the 4.0mm AO Long Drill (7163-1121)

Nail insertion

1. Detach and remove the Anterior Drop.
2. Attach the Cannulated Impactor-Medium (7167-5081) to the Drill Guide (Figure 22).
3. Orient the Drill Guide assembly in the AP (anteroposterior) position.
4. Use the Slotted Hammer (7167-4082) to tap and advance the nail over the guide rod to the desired depth (Figure 22).

   Note: if excessive force is required to insert the nail, additional reaming of the intramedullary canal may be required.
5. Verify fracture reduction as the nail crosses the fracture site, paying close attention to rotation, length, alignment, distraction and/or shortening.
6. Check the final nail position in both the AP and lateral views for correct alignment.

   Note: To obtain provisional fixation of the proximal tibial fragments, reattach the Anterior Drop and insert the gold 9.0mm Drill Sleeve (7163-1152) and silver 4.0mm Drill Sleeve (7167-4083) into one of the two Blocking Screw holes in the Drop, then pass a 4.0mm Long Pilot Drill (7163-1110) through the drill sleeves.

   Note: For proximal interlocking with the leg in extension, use the Extension Drill Guide (7165-4503) and Extension Guide Bolt (7165-4505). The long insertion barrel of the standard Drill Guide may impinge upon the distal femoral condyles and prevent the nail from interlocking with the tibia in full extension (Figure 23).

   Note: The TRIGEN® SURESHOT® Distal Targeting System cannot be used with the META-NAIL® Extension Drill Guide.

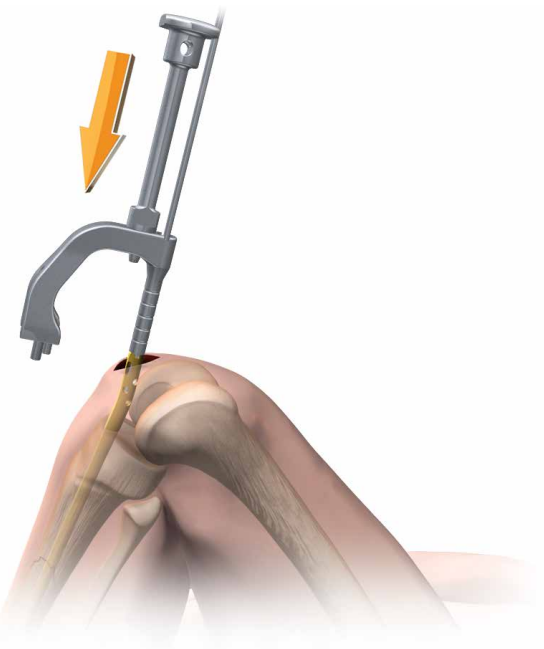


Figure 22

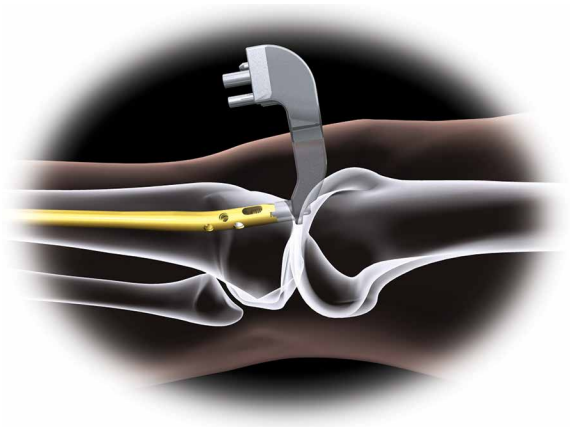


Figure 23

Check nail depth

Check proximal nail depth

In the lateral view, confirm nail position by observing the nail/Drill Guide junction. Each circular groove on the Drill Guide's insertion barrel represents a 10mm depth interval (Figure 24).

Note: If compression or dynamic locking is desired, countersink the nail approximately 10mm in order to avoid implant prominence.

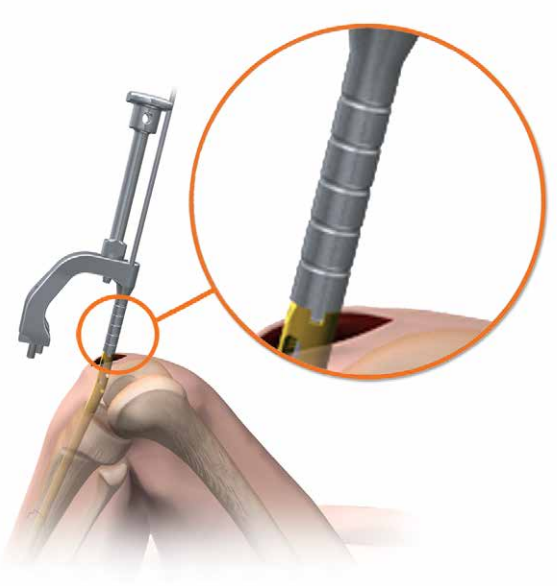


Figure 24

Check distal nail depth

1. In the AP and lateral views, confirm that the nail has been inserted to the desired depth (Figure 25).

   Note: Optimal insertion depth, which will allow room for screw insertion below the fracture, is essential. Distal third tibial fractures require at least three locking screws to maintain stability.

2. Remove the Guide Rod once the nail has been fully seated.
3. Reattach the Anterior Drop.
4. Following nail insertion, confirm that the nail and Drill Guide are securely connected. Hammering can loosen the Guide Bolt.

   Note: For information regarding drilling distal holes and distal screw insertion using the TRIGEN® SURESHOT® Targeting System, refer to the TRIGEN SURESHOT Targeting System User Manual (7118-1540).

Figure 25

Lock the Screw

Determine the Locking Screw length

There are three options available to determine the locking screw lengths:

- The Gold 9.0mm Drill Sleeve, silver 4.0mm Drill Sleeve and 4.0mm Long Pilot Drill* (Figure 26-A)
- The Screw Depth Gauge (7163-1189) (Figure 26-B)
- The Screw Length Sleeve (7167-4085) and 4.0mm Short Drill (7163-1117)** (Figure 26-C)

Note: For information regarding Drill Depth Measurement Software (DDM) using the TRIGEN® SURESHOT® Targeting System, refer to the TRIGEN SURESHOT Targeting System User Manual (7118-1540). The DDM software can be used for distal locking only.

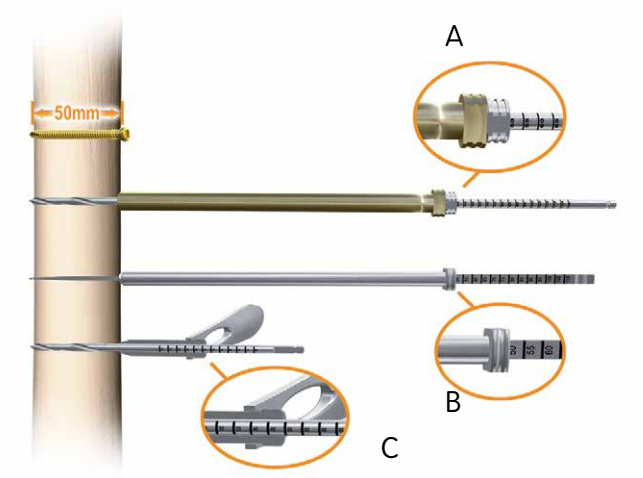


Figure 26

Insert the Locking Screws

Proximal locking options include three statically locked threaded holes and one slot that allows for both fracture compression and/or dynamization (Figure 27). These are targeted through the orange and blue color-coded holes on the Anterior Drop.

Distal locking options include three statically locked holes: two ML (mediolateral) holes and one AP hole. The most distal ML hole is threaded for additional stability.

Gold 5.0mm locking screws are compatible with 10mm, 11.5mm and 13mm diameter nails. Grey 4.5mm locking screws are compatible with 8.5mm diameter nails.

Note: Do not use the 4.0mm Short Step Drill (7164-1123) when drilling for a grey 4.5mm locking screw. Its diameter transitions from 4.0mm to 4.7mm and will drill too large a hole in the near cortex, which may compromise locking screw purchase.

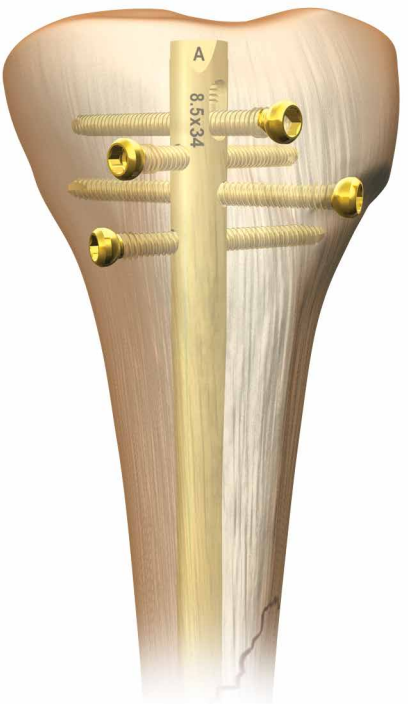


Figure 27:

META-NAIL® Tibial Nail with all four proximal screws inserted

*The 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)
**The 4.0mm Short Drill (7163-1117) is interchangeable with 4.0mm AO Short Drill (7163-1123)

Proximal locking

Static locking

1. Make a small incision at the site of screw entry.
2. Insert the gold 9.0mm Drill Sleeve and silver 4.0mm Drill Sleeve through the static slot on the Anterior Drop (Figure 28) down to bone.
3. Drill both cortices with the 4.0mm Long Pilot Drill*.
4. Measure for screw length using either the calibrations on the 4.0mm Long Pilot Drill* or by removing the 4.0mm Drill Sleeve and using the Screw Depth Gauge.
5. Attach the appropriate length screw to the end of the Medium Hexdriver (7163-1066).
6. Use power to insert the screw through the gold 9.0mm Drill Sleeve until the laser-etched ring on the Hexdriver reaches the back of the Drill Sleeve.
7. Attach the T-handle to the Hexdriver.
8. Tighten the screw by hand.

Figure 28

Dynamic locking

9. With the nail countersunk approximately 10mm, make a small incision at the site of screw entry and insert the gold 9.0mm Drill Sleeve and silver 4.0mm Drill Sleeve through the dynamic slot on the Anterior Drop down to bone (Figures 29 and 30).
10. Drill both cortices with the 4.0mm Long Pilot Drill*.
11. Use the techniques described in the “Lock the Screw” section to measure and insert the screw.

    Note: If the screw is left in the dynamic mode, a nail cap cannot be used as it will push against the locking screw.

Figure 29

Figure 30

*The 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Proximal locking: Compression

One of two compression locking methods can be used:

Compression Driver method

1. Countersink the nail a minimum of 10 mm (Figure 31).
2. Lock the nail distally.
3. Reduce the fracture as much as possible to maximize the advantage of the compression driver.
4. Insert a screw through the proximal side of the dynamic slot as previously described.
5. Remove the gold 9.0mm Drill Sleeve and Medium Hexdriver.
6. Attach the Universal Compression Driver (7165-4528) to the T-handle and thread it through the guide bolt into the top of the nail until it contacts the most proximal 5.0mm locking screw (Figure 32).
7. Advance the Compression Driver by turning it clockwise to drive the locking screw distally, which will compress the fracture up to 7mm (Figure 32).

   Note: If there are screws in the other proximal holes, the fracture cannot be compressed.

   Note: Use flouroscopy to check dynamic screw position when compressing the fracture.
8. Once the fracture gap is fully compressed, lock the nail with up to three additional proximal static screws while the Anterior Drop is still attached to the Drill Guide (Figure 33).

   Note: If the Compression Driver is progressed after the fracture is fully compressed, the locking screw will begin to bend. In extreme cases where excess force is applied, the screw may break upon removal.

Figure 31

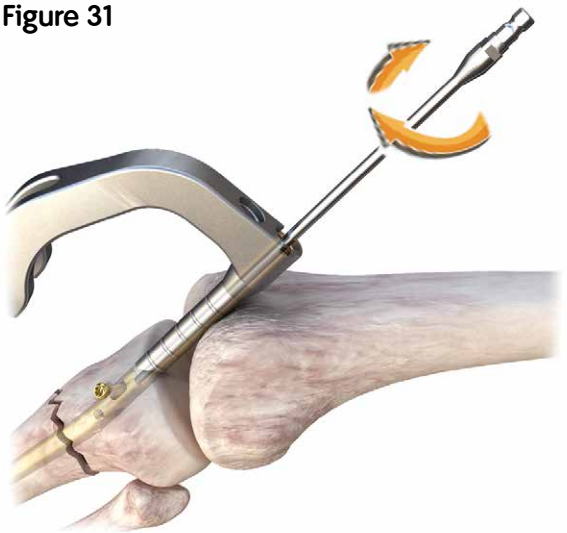


Figure 32

Figure 33

Nail Cap Set Screw method

1. Lock the nail distally, then fully insert the dynamic locking screw as previously described.
2. Remove the Drill Guide/Anterior Drop assembly.
3. Insert the Nail Cap Set Screw (7165-6000) into the top of the nail and advance with the Medium Hexdriver/T-handle assembly until the fracture is compressed and the Nail Cap Set Screw has fully engaged the locking screw (Figures 34a and 34b).

   Note: If there are screws in the other proximal holes, the fracture cannot be compressed.

   Note: Use flouroscopy to check dynamic screw position when compressing the fracture.

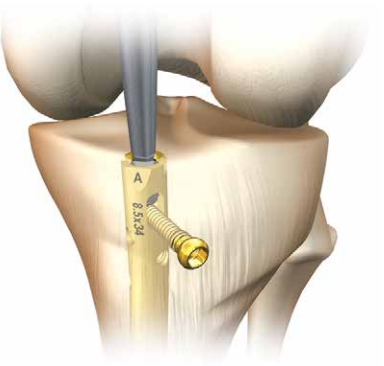


Figure 34a

Figure 34b

Blocking screw technique

Incision and entry point

Make a 2cm incision in line with the intramedullary canal. Orient the incision so that it is patellar splitting, medial or lateral parapatellar.

Note: Locate the entry point just medial to the lateral tibial eminence in the AP view, in line with the anterior cortex and intramedullary canal in the lateral view (Figure 35)

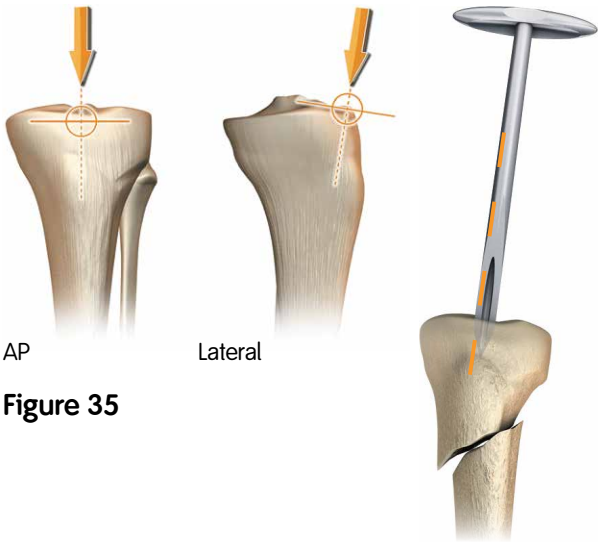


Figure 35

Establish the entry portal

Insert the 11.0mm T-handle Awl (7165-4522) manually to a depth just proximal to the fracture (Figure 36).

Note: When creating the initial entry point, pay close attention to the trajectory of the awl and the relationship to the anatomic axis of the tibia. Correct awl trajectory in the proximal fragment must be established prior to alignment with the anatomic axis of the distal fragment (Figure 36). This will ensure accurate fracture reduction when the nail is inserted.

Figure 36

AP blocking screw insertion

In order to prevent varus or valgus malalignment of the proximal fragment, blocking screws may be placed in the AP plane.

1. Attach the Blocking Screw Device (7165-4515) to the 11.0mm T-handle Awl and move it into the desired position in the AP plane (Figure 37).

   Note: The Blocking Screw Alignment Pins (7165-4523) can be screwed into the three threaded holes on the metal handle of the Blocking Screw Device to serve as external points of reference during fracture alignment.

2. Tighten the device to the awl and insert the appropriate Blocking Screw Cartridge (7165-4511, 7165-4513, or 7165-4514).

3. Adjust the cartridge proximally or distally within the Blocking Screw Device to determine the blocking screw position (Figure 38).

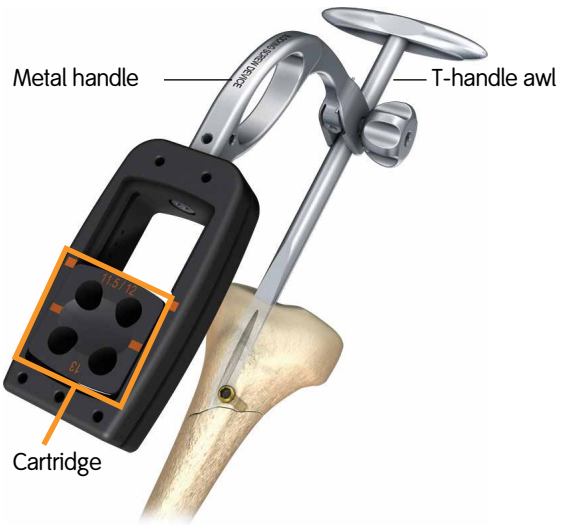


Figure 37

Figure 38

4. Insert the gold 9.0mm Drill Sleeve and silver 4.0 mm Drill Sleeve into the desired cartridge hole and down to the bone (Figure 39).
5. Drill both cortices with the 4.0mm Long Pilot Drill*.

   Note: Use caution during drilling and insertion of the blocking screws in the AP plane. Do not drill past the posterior cortex or insert a screw that is too long. Damage to the neurovascular structures located posterior to the proximal tibia may result.
6. Determine the screw length by reading the exposed drill bit calibrations or by removing the 4.0mm Drill Sleeve and measuring with the Screw Depth Gauge.
7. Use the Medium Hexdriver/T-handle assembly to insert the screw until the screw engages the far cortex.
8. Following implantation of the proximal blocking screw and reduction of the fracture, pass the 11.0mm T-handle Awl into the distal fragment (Figure 40).
9. Reposition either the Blocking Screw Cartridge or the awl as necessary and follow the previously described technique for blocking screw insertion.

Figure 39

Figure 40

ML blocking screw insertion

To prevent anterior or posterior malalignment of the proximal fragment, blocking screws may also be placed in the ML (mediolateral) plane.

1. Attach the Blocking Screw Device to the 11.0mm T-handle Awl.
2. Rotate the blocking screw device into the desired position in the ML plane (Figure 41).
3. Tighten the device to the awl and insert the appropriate Blocking Screw Cartridge (Figure 42).
4. Adjust the cartridge proximally or distally within the Blocking Screw Device to determine blocking screw position.
5. Insert the blocking screw as previously described.

Figure 41

Figure 42

*The 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Blocking screw insertion with a reducer

Blocking screws can also be inserted by attaching the Blocking Screw Device to the Reducer instead of the 11.0mm T-handle Awl (Figure 43). Follow the previously described blocking screw insertion technique.

Final view: AP and ML blocking screw insertion

1. Once blocking screw insertion is complete, remove the Blocking Screw Device from the 11.0mm T-handle Awl or Reducer.
2. Obtain both AP and lateral radiographic images to confirm accurate placement.

   Note: The Awl or Reducer provides a reliable indication of the nail's insertion trajectory based upon the location of the blocking screws.
3. Confirm proper screw placement (Figure 44).
4. Proceed with tibial nail insertion.

Stability blocking screw insertion

Following nail insertion and confirmation of fracture reduction, blocking screws can be placed on either side of the nail in the metaphyseal region for additional stability. Screws may be inserted in both the AP and ML planes.

5. With the nail inserted, attach the Tibial Blocking Screw Attachment (7165-4509) (Figure 45) to the Anterior Drop (triangle to triangle for AP screws and square to square for ML screws).
6. Follow the previously described techniques for cartridge positioning and blocking screw insertion (Figure 46).

   Note: The AP blocking screws targeted through the two holes built into the Anterior Drop cannot be used if the most inferior oblique proximal locking screw has been inserted. The blocking screws are located 53mm below the proximal tip of the nail.

Figure 43

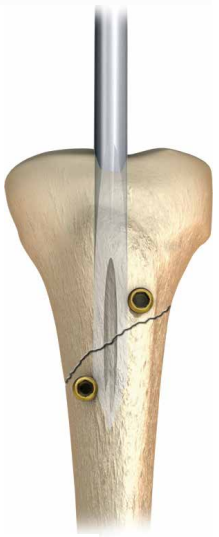


Figure 44

Figure 45

Figure 46

Final view: Stability blocking screws

1. Once stability blocking screw insertion is complete, remove the Blocking Screw Attachment and Anterior Drop from the Drill Guide.
2. Obtain both AP and lateral radiographic images to confirm accurate screw placement (Figures 47 and 48).

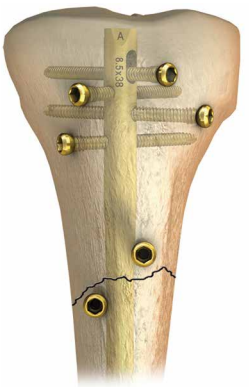


Figure 47

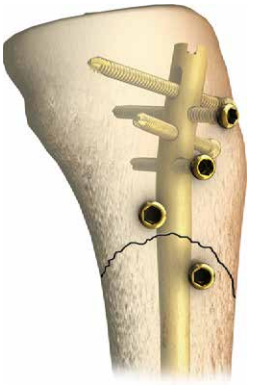


Figure 48

TRIGEN® Nail Cap insertion: *optional*

1. Remove the Drill Guide/Anterior Drop assembly.
2. Attach the selected Nail Cap (Figure 49) to the Medium Hexdriver/T-handle assembly.
3. Insert the Nail Cap into the top of the nail until it is tight.

   Caution: A Nail Cap cannot be used if a Nail Cap Set Screw is implanted or if a locking screw is inserted in the dynamic locking position. The tip of the Nail Cap will contact the locking screw and prevent complete engagement of the Nail Cap with the nail.

   Note: If cross-threading occurs, rotate the Nail Cap counterclockwise until its threads line up with those of the nail. Proceed with the Nail Cap insertion until it is tight. Accurate screw placement (Figures 47 and 48).

Figure 49

Nail extraction: optional

Standard technique

1. Use the Medium Hexdriver/T-handle assembly to remove the Nail Cap or Nail Cap Set Screw, if implanted, all of the distal locking screws, and all but one of the proximal locking screws. (Figure 50).
2. Thread the Cannulated Impactor-Medium (7167-5081) or Cannulated Impactor-Long (7163-1185)* into the back of the Disposable Nail Extractor (7163-1320)**.
3. Thread the assembly into the top of the nail.
4. Remove the remaining proximal locking screw.
5. Use the Slotted Hammer with a back-slapping motion to extract the nail (Figure 50).

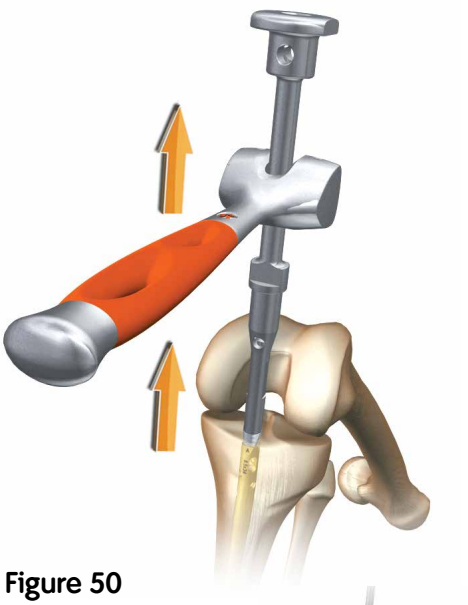


Figure 50

Percutaneous technique

In the absence of a Nail Cap or Nail Cap Set Screw:

6. Use the Medium Hexdriver/T-handle assembly to remove all distal locking screws and all but one of the proximal locking screws.
7. Under fluoroscopy, insert a 3.2mm Brad Point Tip Guide Pin (7167-4130 or 7163-1436) into the top of the nail either using power or by hand (Figure 51).
8. Make a 2cm incision around the pin.
9. Advance the 12.5mm Entry Reamer over the pin and into the top of the nail to remove any bony ingrowth (Figure 52).
10. Thread the Cannulated Impactor-Medium or Cannulated Impactor-Long* (7163-1185) into the back of the Disposable Nail Extractor** (7163-1320).
11. Thread the assembly into the top of the nail.

    Note: It is the flared portion of the Entry Reamer that enters the top of the nail.
12. Remove the remaining proximal locking screw.
13. Extract the nail with a back-slapping motion.

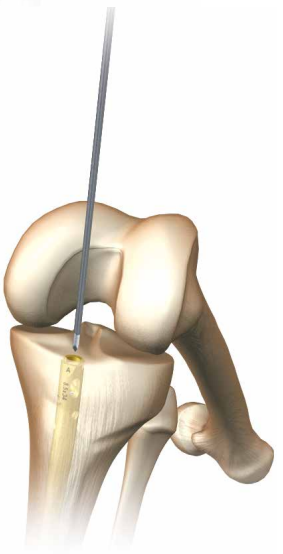


Figure 51

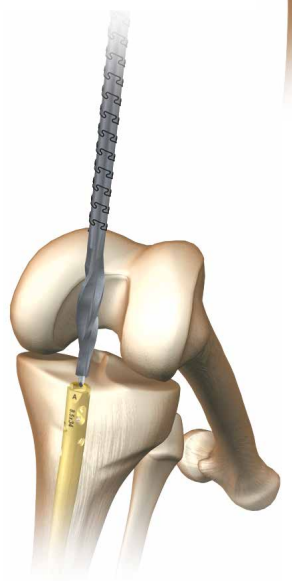


Figure 52

*The Cannulated Impactor-Long is located in the original TRIGEN® Instrument Set (7163-1326)

**The Disposable Nail Extractor (7163-1320) is interchangeable with the Large Nail Extractor located in the original TRIGEN® Instrument Set (7163-1326) and the HFN® Instrument Set (7170-0001)

An alternative method for extraction

Guide rod jamming technique

1. Advance the end of a 3.0mm Ball Tip Guide Rod through the end of the nail.
2. Insert the smooth end of a 2.0mm Ball Tip Guide Rod (7175-1146) in the same manner.
3. With both guide rods in place, attach the Gripper to the end of the 3.0mm Ball Tip Guide Rod.
4. Pull the Gripper back so that it wedges the ball tip against the 2.0mm Guide Rod.
5. Backslap against the Gripper with the Slotted Hammer to extract the nail.

Guide rods	
Cat. No.	**Description**
7163-1626	3.0mm x 1000mm Ball Tip Guide Rod
7175-1146	2.0mm x 600mm Ball Tip Guide Rod

Additional removal items	
Cat. No.	**Description**
115074	Large Extractor Hook*
115073	Small Extractor Hook*

*Available sterile packed. For nail removal only: do not use for nail insertion.

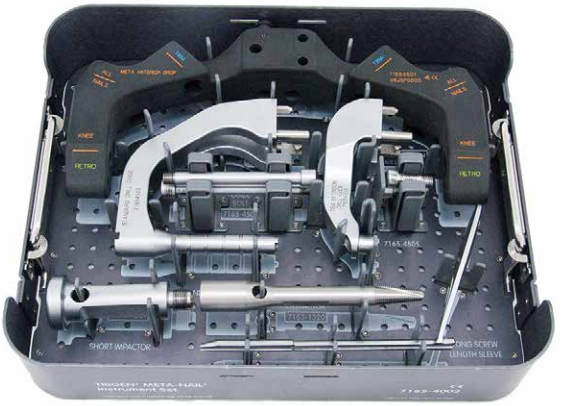
Catalog information

TRIGEN® Base Instrument Set

Set No. 7167-4012

Cat. Item	Description	Qty
7112-9401	Small Outer Case	1
7112-9402	Lid for Outer Case	1
7167-4021	TRIGEN Base Tray	1
7163-1066	Medium Hexdriver	1
7163-1068	Short Hexdriver	1
7163-1116	12.5mm Entry Reamer	1
7163-1140	Guide Bolt Wrench	1
7163-1152	9.0mm Drill Sleeve	2
7163-1161	Multipurpose Driver	1
7163-1186	Mini Connector	1
7163-1189	Screw Depth Gauge	1
7167-4000	Cannulated Awl	1
7167-4060	Entry Portal Tube	1
7167-4074	3.2mm T-handle Trocar	1
7167-4075	Honeycomb	1
7167-4076 or 7167-4576	T-handle	1
7167-4077	Reducer	1
7167-4077	Reducer Connector	1

Cat. Item	Description	Qty
7167-4078	Obturator	1
7167-4079	Ruler	1
7167-4080	Gripper	1
7167-4081	Impactor	1
7167-4082	Slotted Hammer	1
7167-4083	4.0mm Drill Sleeve	2
7167-4084	Screwdriver Release Handle	1
7167-4085	Screw Length Sleeve	1
7167-4092	Entry Portal Handle	1
7167-1212	TRIGEN Reamer Set, Optional	1
7111-8200	SCULPTOR® Flexible Reamer, Optional	1
7163-1130	Flexible Reamer Extender, Optional	1
7164-1123	TRIGEN 4.0 Diaphyseal Drill	1
7163-1121	4.0mm Long AO Pilot Drill, 333mm, Disposable	2
7167-1123	4.0mm Short AO Pilot Drill, 161mm, Disposable	1
7167-4130	3.2mm x 343mm Brad Point Tip Guide Pin, Disposable	3
7163-1070	Long Hexdriver, Optional	1
7175-1153	AO Mini Connector, Optional	1
7163-1187	Trinkle to Mini Connector, Optional	1



TRIGEN® META-NAIL® Instrument Set

Set No. 7165-4002

Cat. Item	Description	Qty
7165-4501	META-NAIL Anterior Drop	1
7165-4502	META-NAIL Drill Guide	1
7165-4503	META-NAIL Extension Drill Guide	1
7165-4505	Extension Guide Bolt (23mm)	2
7165-4506	Guide Bolt Long (51mm)	2
7165-4520	Long Screw Length Sleeve	1
7165-4554	Cannulated Impactor-Short	1
7163-1025	Large Nail Extractor	1

Blocking Screw Instrument Set (Optional)

Set No. 7165-4001

Cat. Item	Description	Qty
7165-4515	Blocking Screw Device	1
7165-4509	Tibial Blocking Screw Attachment	1
7165-4522	11.0mm T-handle Awl	1
7165-4511	8.5mm/10mm Blocking Screw Cartridge	1
7165-4513	11.5mm/13mm Blocking Screw Cartridge	1
7165-4514	Offset Blocking Screw Cartridge	1
7165-4523	Blocking Screw Alignment Pin	2
7163-4508	Retrograde Femoral Blocking Screw Attachment	1

META-NAIL Disposables

Set No. 7165-4003

Cat. Item	Description
7163-1110	4.0mm Long Pilot Drill*
7163-1117	4.0mm Short Drill**
7163-1626	3.0mm x 1000mm Ball Tip Guide Rod
7167-4130 or 7163-1436	3.2mm Brad Point Guide Pin
7165-4528	Universal Compression Driver
7163-1320	Disposable Nail Extractor***

*The 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

**The 4.0mm Short Drill (7163-1117) is interchangeable with 4.0mm AO Short Drill (7163-1123)

***The Disposable Nail Extractor (7163-1320) is interchangeable with the Large Nail Extractor (7163-1278) located in the original TRIGEN Instrument Set (7163-1326) and the HFN® Instrument Set (7170-0001)

Implants

TRIGEN° Internal Captured Screws 4.5mm and 5.0mm

Set No. 71642005 Set No. 7164-2000

Cat. Item	Length
7164-5420	4.5mm x 20mm
7164-5422	4.5mm x 22.5mm
7164-2125	4.5mm x 25mm
7164-2127	4.5mm x 27.5mm
7164-2130	4.5mm x 30mm
7164-5432	4.5mm x 32.5mm
7164-2135	4.5mm x 35mm
7164-5437	4.5mm x 37.5mm
7164-2140	4.5mm x 40mm
7164-5442	4.5mm x 42.5mm
7164-2145	4.5mm x 45mm
7164-5447	4.5mm x 47.5mm
7164-2150	4.5mm x 50mm
7164-5452	4.5mm x 52.5mm
7164-5455	4.5mm x 55mm
7164-5457	4.5mm x 57.5mm
7164-5460	4.5mm x 60mm
7164-5462	4.5mm x 62.5mm
7164-5465	4.5mm x 65mm

Cat. Item	Length
7164-5020	5.0mm x 20mm
7164-5022	5.0mm x 22.5mm
7164-5025	5.0mm x 25mm
7164-5027	5.0mm x 27.5mm
7164-5030	5.0mm x 30mm
7164-5032	5.0mm x 32.5mm
7164-5035	5.0mm x 35mm
7164-5037	5.0mm x 37.5mm
7164-5040	5.0mm x 40mm
7164-5042	5.0mm x 42.5mm
7164-5045	5.0mm x 45mm
7164-5047	5.0mm x 47.5mm
7164-5050	5.0mm x 50mm
7164-5052	5.0mm x 52.5mm
7164-5055	5.0mm x 55mm
7164-5057	5.0mm x 57.5mm
7164-5060	5.0mm x 60mm
7164-5062	5.0mm x 62.5mm
7164-5065	5.0mm x 65mm
7164-5067	5.0mm x 67.5mm
7164-5070	5.0mm x 70mm
7164-5072	5.0mm x 72.5mm
7164-5075	5.0mm x 75mm

4.5mm

5.0mm

TRIGEN META-NAIL° 8.5mm Tibial

Set No. 7165-3002

Cat. Item	Length
7165-5024*	24cm
7165-5026*	26cm
7165-5028*	28cm
7165-5029	29cm
7165-5030*	30cm
7165-5031	31cm
7165-5032*	32cm
7165-5033*	33cm
7165-5034*	34cm

Cat. Item	Length
7165-5035*	35cm
7165-5036*	36cm
7165-5037*	37cm
7165-5038*	38cm
7165-5039	39cm
7165-5040	40cm
7165-5041	41cm
7165-5042	42cm

*Contained in the standard implant set

TRIGEN® META-NAIL® 10mm Tibial

Set No. 7165-3000

Cat. Item	Length
7165-5124	24cm
7165-5126	26cm
7165-5128*	28cm
7165-5129	29cm
7165-5130*	30cm
7165-5131	31cm
7165-5132*	32cm
7165-5133	33cm
7165-5134*	34cm
7165-5135*	35cm
7165-5136*	36cm
7165-5137*	37cm
7165-5138*	38cm
7165-5139*	39cm
7165-5140*	40cm
7165-5141	41cm
7165-5142	42cm

TRIGEN META-NAIL 11.5mm Tibial

Set No. 7165-3001

Cat. Item	Length
7165-5224	24cm
7165-5226	26cm
7165-5228	28cm
7165-5229	29cm
7165-5230*	30cm
7165-5231	31cm
7165-5232*	32cm
7165-5233	33cm
7165-5234*	34cm
7165-5235*	35cm
7165-5236*	36cm
7165-5237*	37cm
7165-5238*	38cm
7165-5239*	39cm
7165-5240*	40cm
7165-5241	41cm
7165-5242	42cm

TRIGEN META-NAIL 13mm Tibial

Cat. Item	Length
7165-5318	18cm
7165-5320	20cm
7165-5322	22cm
7165-5324	24cm
7165-5326	26cm
7165-5328	28cm
7165-5329	29cm
7165-5330	30cm
7165-5331	31cm
7165-5332	32cm
7165-5333	33cm
7165-5334	34cm
7165-5335	35cm
7165-5336	36cm
7165-5337	37cm
7165-5338	38cm
7165-5339	39cm
7165-5340	40cm
7165-5341	41cm
7165-5342	42cm
7165-5343	43cm
7165-5344	44cm
7165-5346	46cm
7165-5348	48cm
7165-5350	50cm

Nail Cap Set Screw

Cat. Item 7165-6000

TRIGEN Nail Caps

Cat. Item	Length
7163-4000	0mm
7163-4005	5mm
7163-4010	10mm
7163-4015	15mm
7163-4020	20mm

*Contained in the standard implant set

Caution: U.S. Federal law restricts these devices to sale by or on the order of a physician.

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